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CHANGE IN POPULATION AND LAND-USE INTENSITIES IN SEVERAL VILLAGES OF THE FOUR NORTHERN REGIONS OF NAMIBIA

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ABSTRACT Demographic changes in several rural areas in the four northern regions of Namibia were traced from 1991 to 2001 using national census data. On average, the population growth rate of the surveyed area was 2.77% per year. Although this rate approximated the country's mean growth rate of 2.64%, the surveyed areas showed significant differences from the mean, ranging from -3.4% to 7.2% per year. A combination of demographic and land use data collected from four representative villages in the study region revealed that rural-to-urban migration on a micro-scale is a significant process in the control of the area's ecology and economy, and that the percentage of cultivated land is closely tied to population density.

Key Words: Namibia; Owamboland; Four northern regions; Population census; Land use intensity.

INTRODUCTION

Since gaining independence in 1990, Namibia has experienced drastic socio-economic changes, resulting in serious environmental changes that are of major concern to international organizations and the NGOs that assist rural development through combating desertification (Desert Research Foundation of Namibia, 1995). However, the assumption that a population increase induces environmental degradation through the overutilization of natural resources lacks substantial evidence in certain local situations, and may lead to misguided rural development strategies. In fact, increased population pressure does not always cause environmental degradation, nor does it necessarily lead to the breakdown of traditional agriculture. Rather, farmers play a crucial role in preventing this by adopting new agricultural strategies, according to changes in their environment. Mortimore (1998) showed that a population increase supported agricultural intensification, such as improved farm management and tree planting, in villages near Kano, Nigeria. In addition, the Akamba farmers of Machakos, Kenya, began to construct terraces that were introduced by the colonial government but these were later abolished (Mortimore, 1998). On the contrary, the environment can be degraded by other reasons than population increase such as the change in cropping patterns.

Demographic statistics demonstrate that the environment and livelihood of Owamboland, now known as the four northern regions of Namibia, are under

threat on a regional scale (Mendelsohn *et al.*, 2000). This paper examines the relationship between population increase and environmental degradation in smaller areas, such as within a specific village, and tests quantitatively the idea that population pressure is a real cause of environmental degradation in the area.

RESEARCH AREA AND METHODOLOGY

I. Research Area

Several areas within the four northern regions (Omusati, Ohangwena, Oshana, and Oshikoto) were selected for demographic analysis and land use survey. Fig. 1 shows the location of the four northern regions in Namibia. These regions occupy 84,600 km² of the land surface of Namibia, or 9.7% of the country's land, and are populated by 780,000 people. The area is separated into three distinct sections: Owamboland, Etosha National Park, and the Tsumeb commercial farming area, with Owamboland comprising the northern 60%. Since the mid-sixteenth century, Owamboland has been the residential area of the Owambo people, whose chiefdoms extend to southern Angola. The Owambo grow pearl millet and graze cattle, assisted by a relatively high annual precipitation of more than 300 mm per year. The land is under the chief's control and is therefore considered communal land. Before gaining independence

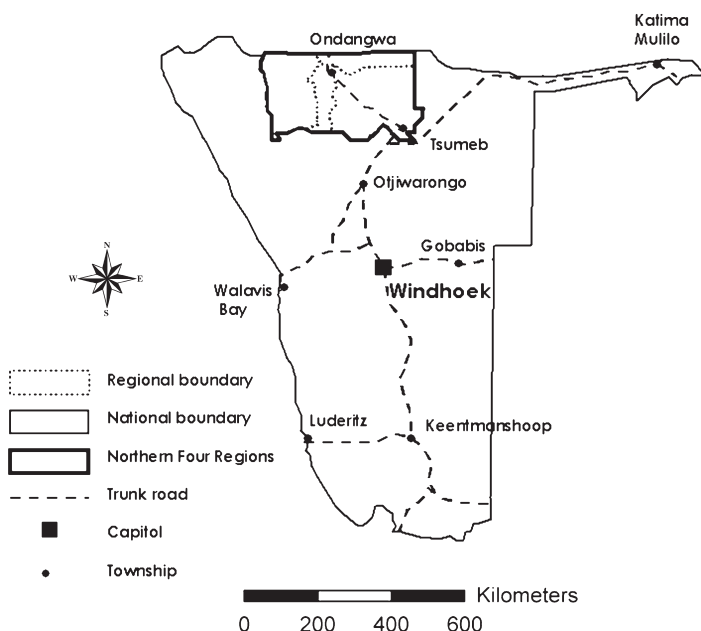


Fig. 1. Location of the four northern regions.

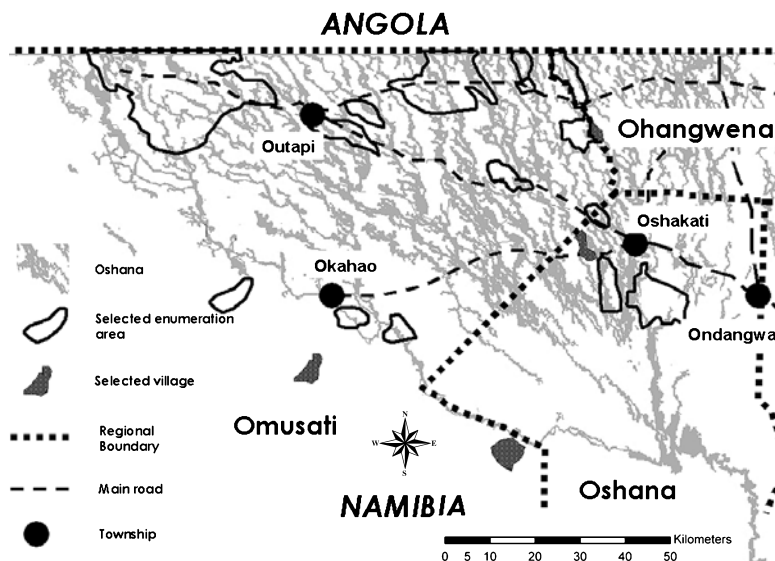


Fig. 2. Research area.

in 1990, the area was one of the homelands under the apartheid regime, and the migration of black people was strictly controlled at the border.

Fig. 2 shows the research area. This area includes part of the catchment area of the Cuvelai River, which collects water from Angola and drains into the Etosha Pan in the south, and is characterized by the domination of the 'oshana', which, in the Owambo language, refers to the drainage networks of seasonal floods. Although the oshana dries up during the dry season, it continues to supply groundwater, making it possible for the Owambo people to settle here permanently. As will be discussed later, population distribution in the area is strongly related to the presence of the oshana.

Outapi and Oshakati are the centers of the Omusati and Oshana regions, respectively, and are home to the regional government offices, whereas local government offices, a lower level of the administration, are located in Okahao and Ondangwa. Fig. 2 also shows the fifteen areas of enumeration used to analyze demographic changes between 1991 and 2001, and the four villages surveyed for current land use status.

The study area, which is about 1100 m above sea level, is topographically very flat, with some minor undulation caused by the oshana and the inter-fluvial hills, composed of Kalahari sand deposits. The vegetation of the area is characterized by a mosaic of grasslands and mopane shrubs, of which *Colophospermum mopane* is dominant (Mendelsohn *et al.*, 2000).

II. Collection of Demographic Data

The Office of the National Planning Commission provided the digitized

national census data for the study areas from 1991 to 2001. These data sets were later combined using GIS software (ArcView), and were examined for changes in population density, and for the relationship between population density and land use. The major problem encountered in this analysis was that the enumeration units, at the lowest level that approximately coincided with the placement of villages, were, in many cases, inconsistent from 1991 to 2001, which made the direct comparison of demography at the lowest level very difficult. To overcome this discrepancy, images of the different enumeration units were superimposed, and composite data, both single and aggregate, were delineated in a series of polygons, as shown in Fig. 1. Although such direct comparison limits the quality of the analysis, because of the varying sizes of enumeration units, the method is valid if the results are interpreted carefully, taking such discrepancies into account.

III. Field Survey

Four villages were selected, based on their respective distances from the Oshakati township and their population densities. Approximately ten households in each village were interviewed regarding their family status, farming activities, and source of income. The area of each family's smallholding and the area of their pearl millet fields were measured using GPS.

IV. Satellite Image Analysis

The band 8 data of Landsat TM7 imagery (path: 180, row: 72), recorded on June 22, 2002, were used to identify the spatial relationships between objects found during the field survey. The proportion of the oshana within a village was measured in the image, and the population density of each village was recalculated by excluding the oshana.

RESULTS AND DISCUSSION

I. Population Trends in Namibia from 1991 to 2001

As shown in Table. 1, the population of Namibia increased from 1.41 million to 1.83 million between 1991 and 2001, with an annual growth rate of 2.6%, while the population of the four northern regions increased from 0.63 million to 0.78 million, with an annual growth rate of 2.1% (Census Bureau of Statistics, 2003). In addition, the proportional population of the four northern regions decreased from 44.9% in 1991 to 42.6% in 2001. Urban-rural distribution showed more drastic changes during this period, as urban areas had a high annual rate of 4.7% population growth, in contrast to the 1.8% increase experienced in rural areas. This can be ascribed to the rural-to-urban migration of people, although the natural growth rates of both urban and rural areas

Table 1. Population trends in Namibia from 1991 to 2001.

	Population in 1991	Percent in 1991	Population in 2001	Percent in 2001	Growth rate per annum (%)
Whole country	1,409,920	100	1,830,330	100	2.6
Northern four regions	633,054	44.9	780,149	42.6	2.1
Urban areas	382,088	27.1	603,612	33.0	4.7
Rural areas	1,027,832	72.9	1,226,718	67.0	1.8

should also be taken into account.

The four northern regions are the most densely populated regions in Namibia. Forty-three percent of the population inhabit only 9.7% of the total land area, so that the population density of the four northern regions can reach 9.25 people/km², far exceeding the country average of 2.1 people/km². Although Namibia is the second most sparsely populated country in Africa after Western Sahara (United Nations, 2002), historical influences and climatic conditions conducive to sedentary agriculture contribute to the relatively high population of the four northern regions.

The current high population of the four northern regions operates as a strong motivator for migration to urban areas. The population of the Katutura area, a residential area of Windhoek for black people, increased from 19,000 in 1968 to 91,000 in 1991, with an attendant increase from 17% to 42% of Owambo people (Pendleton, 1997). Such rural-to-urban migration is not directed solely to the capital; it also affects the country's other urban areas, comprising eighteen municipalities and twelve towns nationwide (Mendelsohn, *et al.*, 2002).

According to United Nations predictions, 57% of the population of developing countries will be concentrated in urban areas by 2030, while the rural population of developing countries will reach a maximum of 3.3 billion, followed by a gradual decrease (United Nations Population Division, 2004). The population of Namibia may follow this trend, but the present high population density of the four northern regions will continue to be a strong motivator with respect to urban migration for years to come.

II. Population change by enumeration areas

The current population density of the research area is based on 2002 census data (Fig. 3). A comparison of Fig. 2 with Fig. 3 reveals that the three townships of Oshakati, Outapi, and Okahao overlap densely populated areas of more than 100 people/km². However, another area with high density in the rural area, indicated by the roman numeral II, is a part of central Owamboland that extends east toward the Ohangwena region. Fig. 3 also illustrates the vital role that oshana plays in residents' lives by providing water, fish, and favorable conditions for pearl millet cultivation. Such an uneven distribution of people requires further analysis from both an environmental and a socio-economic point of view. In addition, Fig. 3 shows the selected enumeration units for demographic analysis. There are fifteen blocks of sampled areas, which are

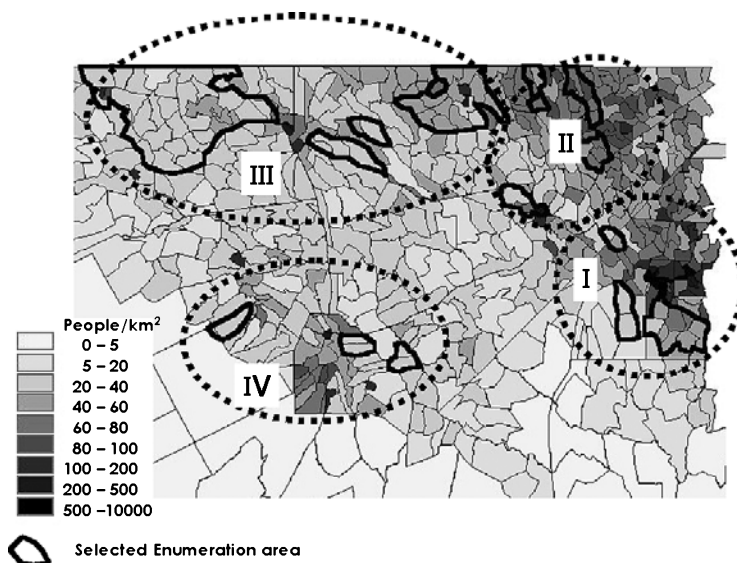


Fig. 3. Selected enumeration areas and population density in 2001.

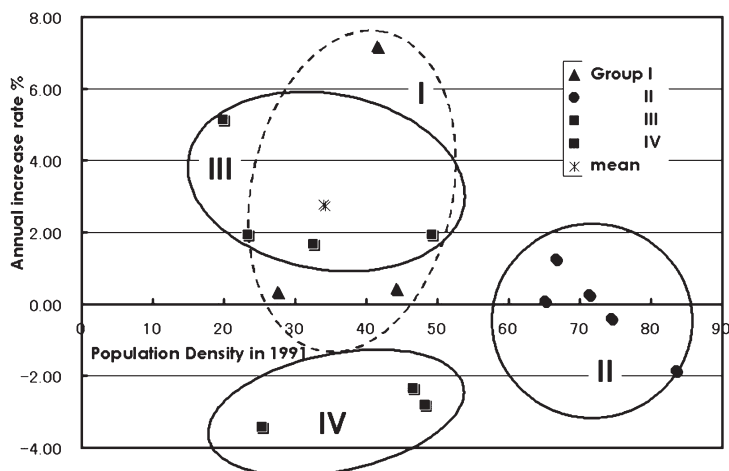


Fig. 4. Relationship between population growth rate and population density in 1991.

conveniently grouped into four classes (I–IV) according to their geographical distribution. Group I can be characterized as lying within the vicinity of Oshakati township, and Group II is a densely populated rural area. Groups III and IV are both distant from Oshakati township, but are closer to local government centers than Groups I and II. The annual population growth rate in each enumeration area from 1991 to 2001 was plotted against the population density of 1991 (Fig. 4). The average annual growth rate of all of the study areas, indicated by *, was 2.77%, which was close to the country's average rate of 2.64%. However, some enumeration areas experienced greater disparities in

growth rates, ranging from -3.4% to 7.2%. Such divergences from the norm can be ascribed to the micro-scale movement of the population within the research area, along with out-migration to other regions. Group II exhibited a narrower range of population growth rate, with an average rate of nearly zero. This may be explained by the fact that Group II is a highly populated rural area, almost saturated with people, and the natural population increase has been forced away from the area, owing to the pressure of overpopulation. Group IV is characterized by a negative growth rate of between -2.8% to -3.4 %. A possible explanation for this could be that the population of Group IV has been absorbed into the nearby Okahao township. Groups I and III include enumeration areas with high growth rates. The 7.2% growth rate found in Group I might be owing to the expansion of Oshakati township. The high growth rate of 5.1%, seen in Group III, has no obvious explanation, although it may be because of some erratic population factors associated with the low population density of 1991.

Since the enumeration areas examined in this study do not include township areas, these changes in growth rate must reflect an important demographic trend occurring in the rural areas of Owamboland. If the relatively high values found in Groups I and III are excluded, the net growth rate becomes 0.6%, a value far below the 1.8% rate estimated for rural areas in the country as a whole (Table 1). In fact, these rural areas include local towns to which people migrated. Therefore, it could be stated that the overall trend in the area is out-migration, and that rural areas have a limited capacity for absorbing people, even when experiencing low population density.

III. Farming Conditions of Small-holders

The four villages selected for household surveys are shown in Fig. 2. Demographical statistics for these villages are listed in Table 2. The population density values are quite diverse, depending on the location of the villages. Village 1 belongs to the densely populated Group II in Fig.3, and Village 2 belongs to Group I, which lies near Oshakati township. Village 3 forms part of a discrete area of high population around Okahao. The least populated village 4, to which migration started in the late 1960s, was once a cattle post used for grazing in the dry season.

When comparing population density values among the villages, differences in

Table 2. Demography and areas of the four villages surveyed.

	Population (2001)	Number of household	Area Km ²	Area excluding oshana	Population density 1	Population density 2*
Village 1	493	64	6.44	5.27	76.55	93.52
Village 2	586	97	14.61	7.83	40.11	74.85
Village 3	1,266	215	20.18	19.50	62.73	64.92
Village 4	585	103	32.46	32.46	18.02	18.02

* Population density calculated on oshana free basis.

the physiological conditions of villages should be taken into account. The proportion of oshana in the village should be excluded from the total area studied, as population density is closely related with the density of field cropping areas. Areas dominated by oshana were traced and calculated in a TM image, and the population density of each village was re-calculated on an oshana-free basis. These values are listed in Table 2 as population density 2. Based on this calculation, the population densities of Villages I and II increased dramatically. To examine the effect of population density on farming conditions, the relationship between household size (number of persons) and the area of pearl millet fields was analyzed (Fig. 5). This figure clearly shows that there is a positive correlation between household size and field area. This is not surprising, given that under subsistence agriculture, household members are inevitably engaged in feeding themselves through land cultivation. The regression coefficient shows that, on average, one person requires 0.5 ha per year for subsistence, which reflects the productivity of land under present agro-environmental and socio-economic conditions. Despite large differences in population densities among the villages studied, there was no clear trend in the relationship between household size and field area. If high population density directly causes fragmentation of the land, it follows that per capita field area would be reduced. Evidently, this is not the case.

Another aspect to be considered is the intensity of land use. As shown in Fig. 6, the typical land use units of a smallholding are: the homestead, crop field, kraal, and grazing land that has been fenced off from other areas to protect the cattle. At each of the four villages, these land use units were measured with GPS, and the resultant tracks were superimposed on a TM image. Fig. 7 illustrates the specific case of Village 3. In order to determine whether differences exist among the villages regarding the allocation of land use units within a smallholding, the population density in a given household

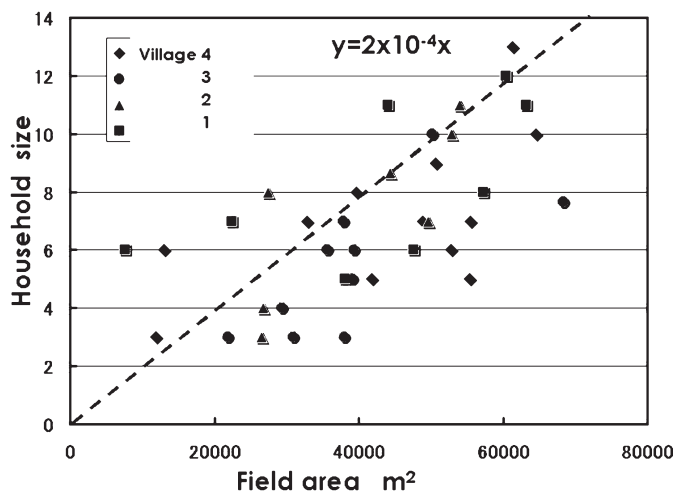


Fig. 5. Relationship between household size and the area of pearl millet field.

level was calculated in two ways. The first is based on the total area of a smallholding, and the other is based on the field cropping area (Fig. 8). The difference between the two values indicates the extent to which the crop field occupies the total area, or the intensity of land use for crop production. Regression lines for each village showed that Villages 3 and 4 had higher coefficient values than the other villages, demonstrating that the areas of smallholdings in Villages 3 and 4 were 2.2 and 2.4 times as big as the crop fields, respectively. The same analysis of Villages 1 and 2 yielded a similar regression line, showing that the crop fields occupied 68%, or $1/1.47$, of the smallholdings. Fig. 8 clearly demonstrates that the number of people who depend on the field units

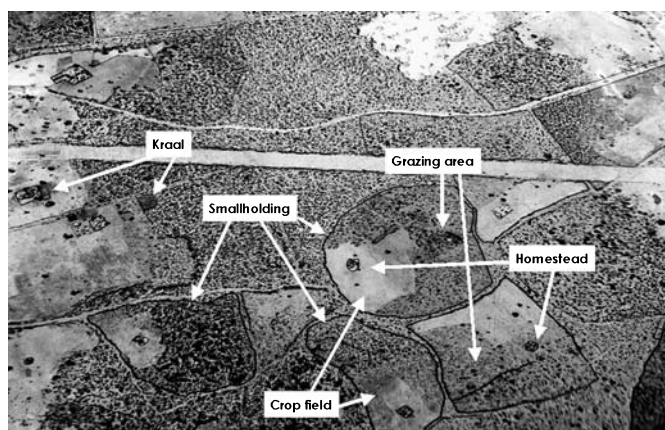


Fig. 6. Composition of smallholdings in the Ovamboland.

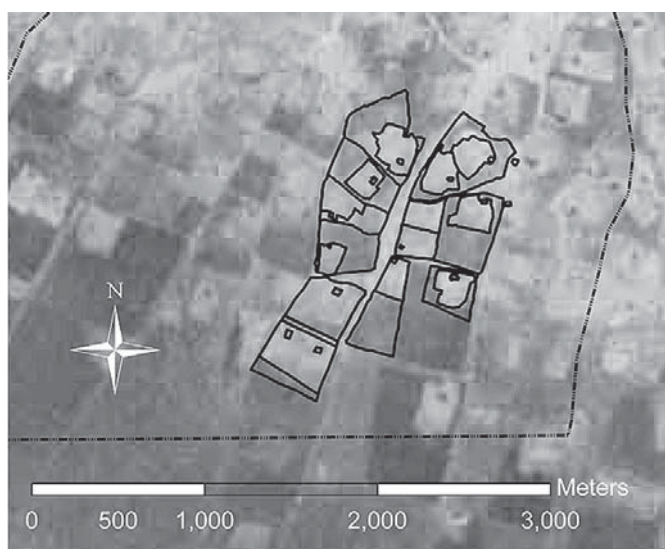


Fig. 7. Area calculation of smallholdings in Village 3.

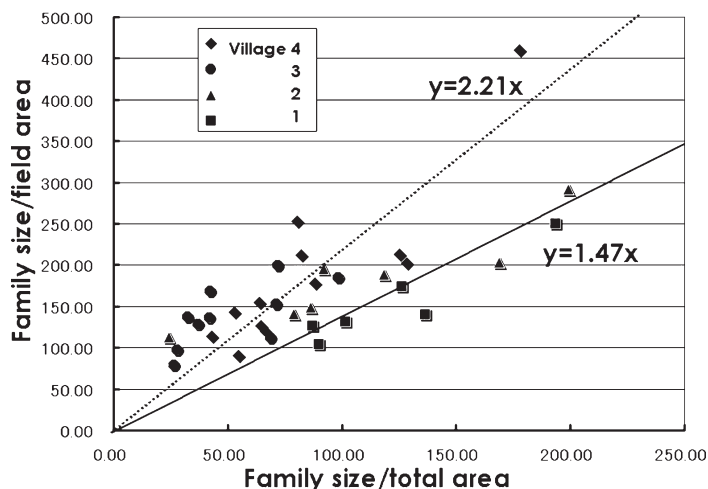


Fig. 8. Relationship between population density in relation to crop field size and in relation to smallholding size.

or smallholdings varies widely, although a mean value of 200 people/km²/field was obtained in this study (Fig. 5). This variance may not ensue directly from the difference in soil productivity but may, instead, be the result of the farmers' socio-economic adjustments.

IV. Population Pressure and Land Use Intensity

As discussed in the previous section, land use intensity (the field:smallholding ratio) was higher in Villages 1 and 2 than in Villages 3 and 4. Population density might be one of the factors that differentiated them. Fig. 9 shows the relationship between the field:smallholding ratio and population density. The population density of each village was adjusted on an oshana-free basis (population density 2 in Table 2). A positive relationship between these factors is evident, although this is based on a limited sample size. There exists a demonstrable land shortage in Villages 1 and 2 (Groups II and I, respectively, Fig. 3), where high population density has forced much of the population to enlarge their pearl millet fields while diminishing the size of grazing land within their smallholdings. The field:smallholding ratio of 68% may be the maximum value for crop production, considering the area of homestead, kraal, and fuel gathering required. The low population growth rate in Group II (Fig. 4) strongly supports the conclusion that the land shortage experienced within this area operates as a strong motivator for migration to urban areas.

CONCLUSION

An analysis of micro-scale changes in demography and land use intensity

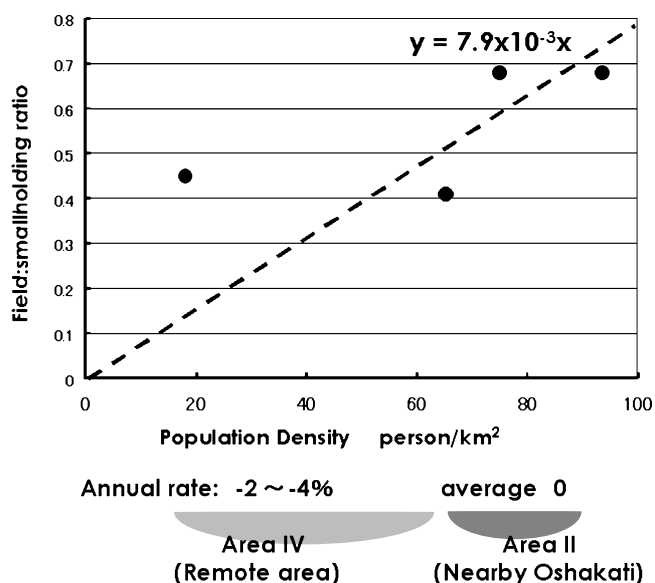


Fig. 9. Relationship between field:smallholding ratio and population density.

revealed that the population growth rate of rural areas remains extremely low, if migration to nearby local townships is excluded from consideration. Because the natural increase in population in rural areas is primarily absorbed outside the region, population pressure is not a real cause of environmental degradation currently found in the area such as continuous field cropping, overstocking of cattle and thinning of vegetation covers (Mendelsohn *et al.*, 2000). This conclusion may not be generalized over to the whole four northern regions, but at least in the studied area, it can be said that rural to urban migration can account for farmers' adaptive strategy to mitigate further stress to the area's fragile environment.

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